

59 % was aged correctly, allowing for the fact that STUBBE (l. c.) did not specify age groups over 36 months old, although his stages V and VI suggest a further wear-age relation.

Extreme disagreement has been found in ZMA reg. no. 4062, 8705 and 10985, which were classed in wear stage II, although their objective age appeared to be 60–67 months. A point of interest is the phenomenon of unequal wear of the molars in both halves. In a number of cases the wear stage of a specimen had to be averaged as left and right molars did not concur.

Objective age and tooth wear in Red Foxes

Fairly ample material from both the Netherlands and France was available, so the two collections were considered separately. Figure 3, which was copied from Wood (1958), represents the wear scheme for Gray Fox first upper molars. Five age groups are distinguished: 0 (0–12 months old), I (12–24 months), II (24–36 months), III (36–48 months) and IV (over 48 months). STUBBE (1965) adapted this scheme to his material of Red Foxes, limiting the number of age groups to four (fig. 1 b): I (8–10 months old), II (20–22 months), III (32–34 months) and IV (over 36 months). As the material upon which the present study is based, was captured in all months of the year, and not as STUBBE's material only from the fall, Wood's scheme (1958) was chosen to be compared with the objective age as it appeared from the dentin layers. From figure 4, which represents the comparison between tooth wear and objective age in Red Foxes from the Netherlands, and figure 5, which represents the same in Red Foxes from France, similar conclusions can be drawn as with the Badgers: a general correlation is apparent, but many specimens have been aged wrongly with the tooth wear method. Only 35 % of the Red Foxes from the Netherlands and 47 % of the French were aged in accordance with their objective age.

Noteworthy disagreements between tooth wear age and real age have been observed in ZMA reg. no. 8710 (8 months old and tooth wear stage II), no. 8763 (12 months old and tooth wear stage III) and no. 15414 (24 months old and tooth wear stage IV). Most disagreements, however, did not exceed the period of one year.

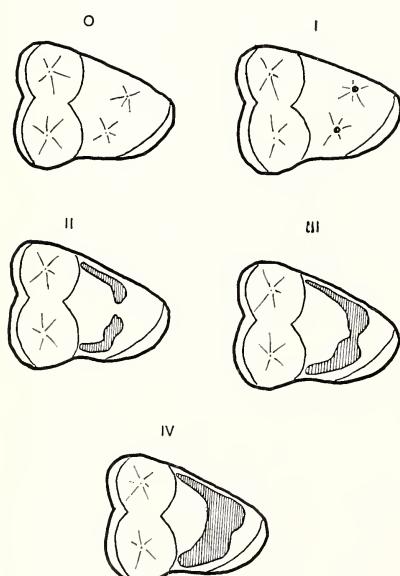


Fig. 3. Tooth wear stages of age Gray Foxes, *Urocyon cinereoargenteus* (Schreber), designed by Wood (1958)

Discussion

From the results presented in this study and those of KERWIN and MITCHELL (1969), KEISS (1971), a. o., it must be concluded that the tooth wear method in general is an unreliable method to assess the age structure of a population sample. The great variability in the wearing process is probably due to such factors as the genetic background of the individuals, the size of the litter they originated from, the structure and the calcium content of the food taken

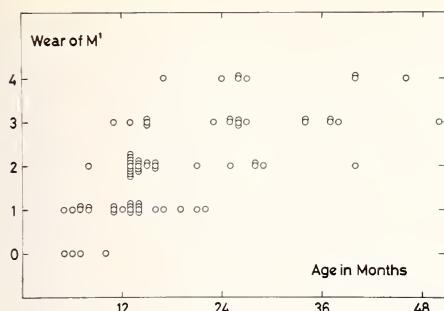


Fig. 4. Comparison of tooth wear age (vertical axis) and objective age, calculated from dentinal growth layers (horizontal axis), in Red Foxes, *Vulpes vulpes* L., from the Netherlands

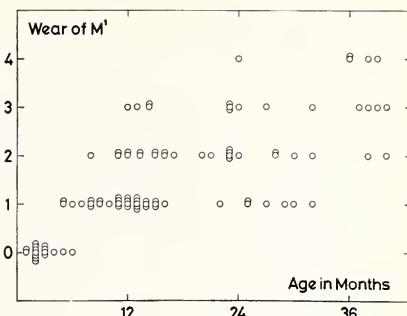


Fig. 5. Comparison of tooth wear age (vertical axis) and objective age, calculated from dentinal growth layers (horizontal axis), in Red Foxes, *Vulpes vulpes* L., from France

regularly and the individual variation in calcium metabolism. Concerning the food taken regularly, it was found by ANDERSEN (1955, after SKOOG 1970) and SKOOG (1970) that the diet of Badgers from Denmark and Sweden depends largely on the availability of the particular kinds of food.

It is possible that the tooth wear method has a greater reliability, when the sampled population lives in an enclosed uniform area, in which factors as food and available calcium are the same for all members of the population. GRAU et al. (1970) proved with captive known age Raccoons that aging by tooth wear of animals which have lived under similar optimal conditions might be nearly as accurate as that by counting annual deposits in the teeth. In most other instances, however, allowance should be made for about 40–60% incorrect aging when studying large samples, and probably still more with small samples.

Zusammenfassung

*Zahnabnutzung zur Bestimmung des Alters bei Dachsen (*Meles meles* L.) und Rotfüchsen (*Vulpes vulpes* L.)*

Die Altersbestimmung von Dachsen (*Meles meles* L.) und Rotfüchsen (*Vulpes vulpes* L.) durch Zahnabnutzungsmerkmale wurde verglichen mit der objektiven Altersbestimmung durch das Zählen jährlicher Wachstumsschichten im Dentin der Zähne. Nur bei 35–60% der untersuchten Exemplare stimmten die beiden Methoden überein. Die Altersbestimmung durch Zahnabnutzungsmerkmale wird als eine unzuverlässige Methode zur Untersuchung der Altersstruktur einer Raubtierpopulation betrachtet.

Summary

Age determination of Badgers (*Meles meles* L.) and Red Foxes (*Vulpes vulpes* L.) by tooth wear characteristics has been compared with the objective age determination by counting the annual growth layers in the dentin of teeth. In 35–60% of the studied specimens tooth wear age and objective aged corresponded. Age determination by tooth wear characteristics is considered an unreliable method to study the age structure of a carnivore population.

References

- Dow, S. A.; WRIGHT, P. L. (1962): Changes in mandibular dentition associated with age in Pronghorn antelope. *J. Wildl. Managem.* 26, 1–18.
- ERICKSON, J. A.; ANDERSON, A. E.; MEDIN, D. E.; BOWDEN, D. C. (1970): Estimating ages of mule deer — an evaluation of technique accuracy. *J. Wildl. Managem.* 34, 523–531.

- GILBERT, F. F.; STOLT, S. L. (1970): Variability in aging Maine white-tailed deer by tooth wear characteristics. *J. Wildl. Managem.* **34**, 532—535.
- GRAU, G. A.; SANDERSON, G. C.; ROGERS, J. P. (1970): Age determination of Raccoons. *J. Wildl. Managem.* **34**, 364—372.
- KEISS, R. E. (1969): Comparison of eruption-wear patterns and cementum annuli as age criteria in elk. *J. Wildl. Managem.* **33**, 175—180.
- KERWIN, M. L.; MITCHELL, G. J. (1971): The validity of the wear-age technique for Alberta pronghorns. *J. Wildl. Managem.* **35**, 743—747.
- KLEVEZAL, G. A.; KLEINENBERG, S. E. (1969): Age determination of mammals by layered structure in teeth and bone. (Akad. Nauk S. S. R., Inst. Morf. Zhiv., Izdatelstvo Nauka, Moscow, 1—144.) Fish. Res. Board Canada, Transl. Ser. 1024, 1—142.
- RIECK, W. (1970): Alter und Gebißabnutzung beim Rehwild. *Z. Jagdw.* **16**, 1—7.
- SKOOG, P. (1970): The food of the Swedish Badger, *Meles meles* L. *Viltrevy* **7**, 1—120.
- STIRLING, I. (1969): Tooth wear as a mortality factor in the Weddell Seal, *Leptonychotes weddelli*. *J. Mammal.* **50**, 559—565.
- STROGANOV, S. U. (1937): A method of age determination and an analysis of the age composition of ermine populations (*Mustela erminea* L.). *Zool. Zhurn.* **16**, 113—129.
- STUBBE, M. (1965): Zur Biologie der Raubtiere eines abgeschlossenen Waldgebietes. *Z. Jagdw.* **11**, 73—102.
- WOOD, J. (1958): Age structure and productivity of a gray fox population. *J. Mammal.* **39**, 74—86.

Authors' address: Dr. P. J. H. VAN BREE, Drs. R. W. M. VAN SOEST and L. STROMAN, Institute of Taxonomic Zoology (Zool. Museum), University of Amsterdam, 53 Plantage Middenlaan, NL - Amsterdam 1004

Wurfzahl und Wurffolge beim nordischen Wiesel (*Mustela nivalis rixosa* Bangs, 1896)

Von F. FRANK

Biologische Bundesanstalt für Land- und Forstwirtschaft, Braunschweig

Eingang des Ms. 12. 5. 1973

Bei ausreichendem Beutetierbestand sind beim mitteleuropäischen Mauswiesel (*Mustela nivalis vulgaris* Erxleben, 1777) zwei Jahreswürfe die Regel. Den Wieseln nördlicher Breiten steht infolge des erheblich kürzeren Sommers keine gleichlange Fortpflanzungszeit zur Verfügung. Dennoch ist ihre Vermehrungsfrequenz offensichtlich nicht geringer und nur erklärbar, wenn gleichfalls zwei Jahreswürfe angekommen werden (O. KALELA 1960 in mündl. Diskussion).

1964 konnte ich ein schwedisches Wiesel-Weibchen in Zucht nehmen, das nach Größe, Gewicht und Färbung der zirkumpolaren Unterart *rixosa* angehörte (genaue Daten in einer weiteren Veröffentlichung). Dieses brachte 1965, 1966 und 1967 je drei Würfe und bewies damit, daß auch das nordische Wiesel physiologisch auf mehr als einen Jahreswurf eingestellt ist. Daß es im natürlichen Verbreitungsgebiet mehr als zwei sein könnten, ist allerdings unwahrscheinlich. Der in Gefangenschaft produzierte dritte Wurf dürfte als Reaktion auf den längeren mitteleuropäischen Sommer